Problem Set 1, due friday, Sept. 8

1) Given the multiplicity function

$$g(x) = \frac{N!}{(N-x)!\,x!}$$

show that

$$\sum_{x=0}^{N} g(x) = 2^N$$

2) Assume that 5 people are rolling the die at the same time just as we flipped the coins in class.
a) What is the total number of possible permutations (states)?
b) What is the number of possibilities (multiplicity of states) that 2 people obtain the same number and the other 3 have numbers different from these?
c) What is the probability that 3 people get the same number?

3) Show that

$$< x^2 > \geq < x >^2$$

4) Determine the root mean dispersion $\sqrt{< (x - < x >)^2 >}$ for a system with gaussian multiplicity function given by

$$g(x) = \sqrt{\frac{2}{\pi N}}\, 2^N \; exp(-2(x - x_0)^2/N)$$

Use the continous approximation: $\sum_s \rightarrow \int ds$
Please verify that

$$\int_{-\infty}^{\infty} g(x)dx = 2^N$$